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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	)	A POWER TRANSMISSION BELT HAVING A MARK THEREON AND A METHOD OF PROVIDING A MARK ON A POWER TRANSMISSION BELT
SOKICHI NOSAKA ET AL	)	
Ser. No.: 09/772,137	)	
Filed: 1/29/01	)	Examiner: Marcus Charles Art Unit: 3682

CORRECTED APPELLANT'S BRIEF ON APPEAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313

Sir:

Real Party in Interest

The real party in interest is Mitsuboshi Belting Ltd., the assignee of all right, title and interest in and to the above-identified invention.

Related Appeals and Interferences

None

Status of Claims

Claims 1, 4-7, 9-35 and 38-41 are currently pending in the application. Claims 21-35 have been withdrawn from consideration. Claims 1, 4-7, 9-20 and 38-41 stand rejected. The June 3, 2005 rejection of claims 1, 4-7, 9-20 and 38-41 is appealed herein.

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37 CFR 1.8
CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on 11-13-06 (date).

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Status of Amendments

None

Summary of Claimed Subject Matter

The claimed invention is directed to a method of providing a mark on a power transmission belt. The power transmission belt may take any of a number of different forms, among which are: a) a double, V-ribbed belt 10 as shown in Fig. 1 and described in Appellant's specification on page 6, beginning at line 14, through page 7, line 6; b) a flat belt 70, as shown in Fig. 4 and described in Appellant's specification on page 13, lines 10-18; c) a cog belt 90, as shown in Fig. 5 and described in Appellant's specification beginning at page 13, line 19, through page 15, line 15; d) a V-ribbed belt 126, as shown in Fig. 6 and described in Appellant's specification on page 15, at lines 16-24; and e) a V-belt 140, as shown in Fig. 7 and described in Appellant's specification on page 16, lines 1-6.

Each of the above power transmission belts has a body with oppositely facing side surfaces: a) side surfaces 34, 36 on the body 12 for the belt 10, as shown in Fig. 1, are described in Appellant's specification on page 7, lines 7 and 8; b) side surfaces 82, 84 on the body 72 of the belt 70, shown in Fig. 4, are described in Appellant's specification on page 13, lines 13-15; c) side surfaces 106, 108 on the body 92 on the belt 90, shown in Fig. 5, are described in Appellant's specification on page 14, lines 1-4; d) side surfaces 120, 122 on the body 124 on the belt 126, shown in Fig. 6, are described in Appellant's specification on page 15, lines 16-18; and e) side surfaces 144, 146 on the body 142, on the belt shown in Fig. 7, are described in Appellant's specification on page 16, lines 1-3.

The method of providing a mark may be practiced in substantially the same manner, regardless of the form of the belt. The mark is applied to the belt body side surfaces, as

also described above. For purposes of explanation herein, the method will be described only with respect to providing the mark 32 on the exemplary belt 10, shown in Fig. 1.

The nature of the mark 32 is not limited and may convey virtually any type of information desirable to be placed upon a power transmission belt. The designation "ABC" in Fig. 1 is intended to be a generic showing of this type of information (see Appellant's specification page 7, lines 7-14).

The body 12 of the V-ribbed belt 10 has an inside 14 and an outside 16. The body 12 further has a cushion rubber layer 22 with at least one load carrying member 24 embedded therein (see Fig. 1 and Appellant's specification page 6, lines 14-20).

Laterally spaced, triangularly-shaped ribs 28, 30 are provided on the inside and outside of the belt body 12 (see Fig. 1 and Appellant's specification page 6, line 22 through page 7, line 6). As seen in Fig. 1, the ribs 28, 30 are each triangularly-shaped to engage in complementarily-shaped pulley grooves (not shown) such that the angled portions on the side surfaces 34, 36 on the ribs 28, 30 directly engage facing pulley surfaces.

The mark 32, in the form shown in Fig. 1, extends sufficiently in an inside and outside direction that it is applied to the portions of the ribs 28, 30 that directly engage the cooperating pulley (see also Appellant's specification page 7, in the first full paragraph, as amended in Amendment "A" filed on July 25, 2003).

The mark 32 is applied directly on at least one of the side surfaces 34, 36 to directly alter that side surface(s) 34, 36 (see Fig. 1 and Appellant's specification page 7 in the first full paragraph, as amended in Amendment "A", filed on July 25, 2003). More specifically, this alteration is effected by inscribing the side surface 34, 36 to a depth of from 0.1 to 1 mm. The inscribing is preferably carried out through laser beam irradiation (see Appellant's specification page 7, line 15). By using a laser beam 42, a small part of a

rubber component and potentially fibers in the load carrying cords 24 are vaporized so as to form depressions 38 (see Fig. 1 and Appellant's specification page 9, lines 1-4).

After the depression is formed, a material, contrasting in color with the portion of the side surface at which the depression is formed, is applied in the depression 38 to highlight the mark 32 (see Appellant's specification page 10, lines 4-12).

In one form, a depression 38 is formed at least partially directly in the load carrying cord 24 (see Appellant's specification page 8, lines 4-6).

The laser operation can be performed with the belt 10 in a fixed position (see Figs. 2 and 3 and Appellant's specification page 8, lines 19 and 20). The laser beam angle of reflection can be adjusted using at least one scanning mirror 52, 54 (see Fig. 2 and Appellant's specification page 8, lines 16-18).

Grounds of Rejection to be Reviewed on Appeal

Ground No. 1

The rejection of claims 1, 9 and 41 as obvious under 35 USC §103 over U.S. Patent No. 6,103,349 (Matsumoto) in view of U.S. Patent No. 4,997,994, to Andrews et al (Andrews).

Ground No. 2

The rejection of claims 4-7, 10-20 and 38-40 as obvious under 35 USC §103 over Matsumoto in view of Andrews, and further in view of Japanese Patent Publication No. 10252833 (Japan '833).

ARGUMENT

Ground No. 1

Claim 1 is directed to a method of providing a mark on a power transmission belt having a body with a length and exposed, laterally spaced side surfaces. The side surfaces include portions to engage a cooperating pulley. The method includes the step of forming a mark directly on the at least one laterally spaced side surface by inscribing the at least one laterally spaced side surface to a depth of from 0.1 to 1 mm. Further, at least a part of the mark is formed directly on at least one of the portions of at least one of the laterally spaced side surfaces that engages a cooperating pulley.

In ¶3 of the Action, the Examiner argues that Matsumoto discloses that the marking (3) therein may be provided "over the entire belt side surface, indicating that the making [sic] may be provided unto the belt-engaging portion" (page 2, last two lines). To support this, the Examiner refers to column 4, lines 5 and 6 of Matsumoto, which describe that the hiding layer 4 may be provided "over the entire belt side face". However, Matsumoto defines the "belt side face" to exclude that portion which engages a pulley. More specifically, as stated in column 3, lines 46-48 of Matsumoto, "the side face ... is a surface of the belt body 1 other than the bottom face as a contact surface in contact with the pulleys...". The "bottom face" is defined in the sentence there preceding as the "contact surface" (see column 3, line 45). Thus, the "side face" expressly excludes the "contact surface" portion that contacts a cooperating pulley.

Matsumoto consistently teaches away from placing the mark on any surface that contacts a pulley. Some examples thereof are identified below.

In column 1, beginning on line 66 and continuing through column 2, line 3, it is stated: "[t]o attain the above object, in the present invention, a mark indicating the history

of belt manufacturing is placed not on a surface of the belt in contact with pulleys, such as the belt back face, but on a surface of the belt not in contact with the pulleys ..." (our emphasis).

In column 2, at lines 15-17, it is stated: "the mark indicating the history of belt manufacturing is provided on a surface of the belt other than the contact surface in contact with the pulleys, that is, on a surface of the belt that causes no contact and no friction with the pulleys..." (our emphasis).

In the Description of Preferred Embodiments, in column 3, lines 61-63, it is stated "the history of belt manufacturing is placed on the belt side face not in contact with the pulleys".

In the single independent claim, Matsumoto recites that the identifying mark is "disposed on the non-contact portion of the at least one side face".

Aside from teaching away from the specific limitation in Appellant's claim 1 that a part of the mark extends to a portion of a side surface that contracts a cooperating pulley, Matsumoto does not teach or suggest inscribing to any depth on a side surface of a belt. Substantially the entirety of Matsumoto's description concerns the application of the mark 3 using a separately added hiding layer 4, which is applied to a non-contact surface.

The Examiner has not cited any prior art which teaches to directly alter the side surface of a belt through depression-forming inscription. Appellant submits that the total absence of such an alteration is consistent with the industry's belief that the side surfaces of power transmission belts should not be inscribed to any depth, for fear of adversely affecting operating characteristics of the belt. The Appellant has determined that inscription to the depth in the recited range does not appreciably affect the performance of the belts

or their life expectancy. At the same time, the mark tends to remain intact to identify potentially useful information after a substantial period of belt running.

Matsumoto, as an alternative to depression-forming inscription, teaches mark application through the use of the hiding layer 4, for the preferred embodiment. The hiding layer is not the same as an inscription, but rather, is an addition to the side surface, and thereby represents no alteration as claimed to the side surfaces of the belt.

As an alternative to using a hiding layer, Matsumoto makes passing reference to the application of the mark directly upon the belt side surface. In column 4, lines 8-12, Matsumoto states that "in the case that the mark 3 can be sufficiently read without the hiding of the belt texture, for example, when the cord is not embedded or the mark 3 has larger letters, the mark 3 can be directly provided on the belt side face without using the hiding layer 4". However, this statement does not suggest inscription to any depth on the belt side surfaces.

The inscription to the depth recited in Appellant's claim 1 potentially allows legibility even when the mark is applied over a load carrying cord or elsewhere wherein there is "texture" that might obstruct the ability to see basic "printing", as taught in Matsumoto.

The Examiner relies upon Andrews for the disclosure therein of inscription of an element to the claimed depth. It is respectfully submitted that Andrews' teachings are not obviously combinable with Matsumoto's. Matsumoto is concerned with a power transmission belt having primarily rubber and fibrous components in a dynamic environment. Andrews is concerned with marking "[a]n elongated material such as a cable" (see Abstract line 1). The cable 20 in Andrews characterized as having a jacket 32 made from a plastic material (see column 3, lines 56-63). The jacket 32 is homogeneous

in construction and presumably is designed to function with the marking thereon in a static environment.

The significance of depth of inscription in a product, such as that disclosed in Andrews in a static environment, has little meaning in designing a belt in a dynamic environment that is subjected to bending and frictional forces in use. It is respectfully submitted that one skilled in the power transmission belt art would not look to the teachings in a static cable environment to determine whether inscription, or what depth of inscription, would be appropriate with respect to a belt side surface that is repeatedly bending and moving repetitively into and out of contact with a cooperating pulley. The difference in composition of the materials on the jacket in Andrews versus the side surfaces in Matsumoto i.e. homogeneous plastic or rubber and fiber components, makes the combination even less obvious and more inappropriate.

Accordingly, claim 1 is believed allowable.

Claim 9

Claim 9 depends from claim 1 and characterizes the inscribing as forming a depression in one of the side surfaces and further recites the step of directing material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces in which the depression is formed.

Since a) Matsumoto lacks any teaching of inscribing to any depth on a belt side surface and b) Andrews, which discloses a contrasting pigment filling in indentations on a cable, is not obviously combinable with Matsumoto, the claimed additional step of adding contrasting material to the depression further distinguishes over Matsumoto, thereby potentially providing a more clearly visible mark in the gelt environment.

Claim 41

Claim 41 is directed to a method of providing a mark on a power transmission belt having a body with spaced side surfaces, including a cushion rubber layer with at least one load carrying member embedded therein, and a tension layer. The method includes the step of altering at least one of the laterally spaced side surfaces by forming an informational mark directly on the at least one laterally spaced side surface by an inscribing process to a depth of 0.1 to 1 mm so that at least part of the mark is formed on the at least one laterally spaced side surface in the tension layer and on the at least one load carrying member on the at least one laterally spaced side surface.

As noted above, Matsumoto does not teach or suggest any alteration of a belt side surface through depression-forming inscription. As further noted above, the lack of citation of any prior art that alters the belt side surface by inscription to any depth to produce a mark is indicative of the fact that the industry has purposely avoided any such alteration of side surfaces of belts. Appellant has found that side surface alteration is possible, within the stated parameters, without having a significant adverse effect on the operating characteristics of the belt. By being able to directly inscribe the load carrying member to a depth within the claimed range, the use of the hiding layer, as required in Matsumoto, is obviated and a mark can be produced even where the texture of the belt varies significantly.

It is also noted that claim 41 does not require the formation of any part of the mark on a side surface portion that engages a cooperating pulley. However, claim 41, in the absence of this requirement, distinguishes over the applied art. Claim 41 is thus believed allowable.

Ground No. 2

The remaining claims stand rejected based upon the combination of Matsumoto and Andrews, and further in view of Japan '833. Japan '833 is directed to the formation of a mark through a laser on a "belt back face" that is used as a "driving surface". Japan '833 does not teach or suggest the lasing of either side surface of a belt.

It is respectfully submitted that it is improper to combine the teachings of Japan '833 with Matsumoto and Andrews. Generally, the back face of a power transmission belt is defined by a fabric layer. Through the use of a laser, the surface appearance of the fabric can be altered to produce a contrast that allows the mark to be formed. Japan '833 relates to the Appellant's own technology. Appellant submits that the use of the laser, as in Japan '833 and on a "back face" of a belt, is a very different concept than using a laser on a pulley-engaging belt side surface.

The Appellant respectfully submits that the teachings of Matsumoto, Andrews and Japan '833, in combination, do not teach or suggest to one skilled in this art, the basic method steps recited in claim 38 or 40 or in base claim 1, from which claims 4-7 and 10-20 depend. As noted above, Matsumoto does not teach inscribing of a belt side surface to any depth. Japan '833 is not directed to any marking of a belt side surface. Andrews relates to lasing of a plastic sheet on a cable in a static environment that does not relate to the power transmission art . Accordingly, the remaining claims are believed allowable.

Claim 4

Claim 4 recites that the inscribing is performed using a laser beam. The prior art, taken individually or in combination, does not teach or suggest any type of inscription of a belt side surface to any depth, let alone use of a laser beam to effect this end.

Claim 5

Claim 5 characterizes the mark as inscribed with a laser beam with an angle of reflection that is adjusted using at least one scanning mirror. Since the art does not teach or suggest inscribing side surfaces of a belt using a laser beam, the further limitation relating to control of the laser beam further distinguishes over the prior art.

Claims 10, 11, 18-20

Claims 10, 11 and 18-20 each require that the mark is inscribed with a laser beam with the belt body maintained in a stationary position. Only Japan '833 relates to the use of a laser beam to treat any part of a power transmission belt. Japan '833 teaches that the belt being lased is placed on a movable support stand which is shifted relative to the laser beam. Aside from the fact that it would not be obvious to combine Japan '833 with Matsumoto and Andrews, even in combination this limitation is not met.

Claims 6 and 12-14

Claims 6 and 12-14 relate to a specific configuration of belt. Appellant submits that these claims are allowable by reason of the limitations in independent claim 1, on which they are based.

Claims 7 and 15-17

Each of claims 7 and 15-17 recites the formation of a depression and the direction of material into the depression to contrast and highlight the mark. The significance of this limitation is set out in the arguments advanced relative to the allowability of claim 9.

Claim 38

Claim 38 recites a method of providing a mark on a power transmission belt having a body with a length and laterally spaced side surfaces. Each side surface has a portion to engage a cooperating pulley. The method includes the step of altering at least one of the laterally spaced side surfaces by forming an informational mark directly on the at least one laterally spaced side surface by an inscribing process to a depth of 0.1 to 1 mm at least partially on the portion of the at least one laterally spaced side surface.

The arguments advanced relative to the allowability of claim 1 apply equally to claim 38. Notably, it would not be obvious to combine the teachings of Andrews with Matsumoto to inscribe a side surface of the belt to any depth, let alone that stated, to produce an informational mark.

Japan '833 adds little to support the rejection in that claim 38 does not expressly recite the use of a laser. Japan '833 does not teach alteration of a belt side surface. Thus, in combination, the three cited references do not make obvious the alteration of a belt side surface ,as through inscription to the claimed depth.

Claim 39

The arguments advanced relative to the allowability of claim 9 apply equally to claim 39.

Claim 40

Claim 40 recites a method of providing a mark on a power transmission belt having a body with a length and exposed laterally spaced side surfaces. The method comprises the steps of altering at least one of the side surfaces by forming a mark directly thereon through inscribing to a depth of 0.1 to 1 mm with a laser beam. The laser beam forms a depression into which contrasting material is provided.

Claim 40 includes limitations, described with respect to claims 1 and 38, that are not taught or suggested by the cited art, particularly the inscribing of the side surface to a depth of 0.1 to 1 mm. Claim 40 additionally characterizes the mark as being inscribed using a laser beam.

Andrews is relied upon for the disclosure of the use of a laser beam to inscribe a surface. However, Andrews' lasing step is performed on a homogeneous plastic layer, apparently to a depth significantly less than the radial thickness of that layer. This is a different concept than lasing the side surface of a belt at which there is a combination of fibrous load carrying cords or layers and rubber, as well as potentially other components.

Japan '833 teaches lasing of a back surface of a belt, which is typically defined by a fabric layer. Japan '833, Appellant's own prior art, does not hint at the idea of lasing side surfaces of a belt.

As Appellant notes on page 9 in the first full paragraph of Appellant's specification, it has been found that using a laser beam to the depth claimed causes an instantaneous melting of only a small part of the rubber as well as potentially fibers in the load carrying cords to produce a visible mark without significantly adversely altering the structure of the belt. Appellant respectfully submits that while lasing of surfaces to facilitate printing is known, the lasing of a homogeneous layer, such as that in Andrews on a product in a static environment, or a fabric layer on a back surface as in Japan '833, would not motivate one skilled in this art to lase a side surface of a belt that has potentially several different compositions and components.

To the extent that the limitations overlap, the arguments advanced relative to the allowability of claims 9 and 38 likewise apply to claim 40.

Claim 40 does not require that the mark, or any part thereof, be provided on pulley contacting side surface portions. However, without that limitation, claim 40 distinguishes over the combination of Matsumoto, Andrews and Japan '833 and is believed allowable.

CONCLUSION

It is respectfully submitted that the absence of the teaching in any prior art reference cited of inscribing a side surface of a belt to any depth in applying a mark, in the very crowded power transmission belt art, supports the unobviousness of the claimed invention. It is submitted that the art applied by the Examiner does not teach or make obvious any alteration through depression-forming inscription of a belt side surface, without using Appellant's teachings as a template and impermissibly relying on hindsight.

Accordingly, it is respectfully requested that the Board reverse the Examiner's rejection of claims 1, 4-7, 9-28 and 38-41.

Respectfully submitted,

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CLAIMS APPENDIX

1. A method of providing a mark on a power transmission belt having a body with a length and exposed laterally spaced side surfaces, including portions to engage a cooperating pulley, said method comprising the step of:

forming a mark directly on the at least one laterally spaced side surface by inscribing the at least one laterally spaced side surface to a depth of 0.1 to 1 mm and so that at least a part of the mark is formed directly on at least one of the portions of at least one of the laterally spaced side surfaces.

2.-3. (cancelled)

4. The method of providing a mark on a power transmission belt according to claim 1 wherein the mark is inscribed with a laser beam.

5. The method of providing a mark on a power transmission belt according to claim 4 wherein the mark is inscribed with the laser beam with an angle of reflection that is adjusted using at least one scanning mirror.

6. The method of providing a mark on a power transmission belt according to claim 4 wherein the body comprises an inside and an outside, and the power transmission belt comprises a double V-ribbed belt comprising laterally spaced ribs extending lengthwise of the body on the inside and outside of the body, a cushion rubber layer, and at least one load carrying member in the cushion rubber layer and extending lengthwise with respect to the body.

7. The method of providing a mark on a power transmission belt according to claim 4 wherein the laser beam forms a depression in the at least one of the laterally spaced side surfaces and further comprising the step of directing a material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces.

8. (cancelled)

9. The method of providing a mark on a power transmission belt according to claim 1 wherein the inscribing forms a depression in the at least one of the laterally spaced side surfaces and further comprising the step of directing a material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces.

10. The method of providing a mark on a power transmission belt according to claim 4 wherein the mark is inscribed with a laser beam with the body maintained in a stationary position.

11. The method of providing a mark on a power transmission belt according to claim 6 wherein the mark is inscribed with a laser beam with the body maintained in a stationary position.

12. The method of providing a mark on a power transmission belt according to claim 4 wherein the power transmission belt comprises a V belt.

13. The method of providing a mark on a power transmission belt according to claim 4 wherein the power transmission belt comprises a cog belt with teeth spaced lengthwise of the body.

14. The method of providing a mark on a power transmission belt according to claim 4 wherein the body comprises an inside and an outside and there are flat surfaces on the inside and outside of the body.

15. The method of providing a mark on a power transmission belt according to claim 12 wherein the laser beam forms a depression in the at least one of the laterally spaced side surfaces and further comprising the step of directing a material into the

depression, which material contrasts with the at least one of the laterally spaced side surfaces.

16. The method of providing a mark on a power transmission belt according to claim 13 wherein the laser beam forms a depression in the at least one of the laterally spaced side surfaces and further comprising the step of directing a material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces.

17. The method of providing a mark on a power transmission belt according to claim 14 wherein the laser beam forms a depression in the at least one of the laterally spaced side surfaces and further comprising the step of directing a material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces.

18. The method of providing a mark on a power transmission belt according to claim 12 wherein the mark is inscribed with a laser beam with the body maintained in a stationary position.

19. The method of providing a mark on a power transmission belt according to claim 13 wherein the mark is inscribed with a laser beam with the body maintained in a stationary position.

20. The method of providing a mark on a power transmission belt according to claim 14 wherein the mark is inscribed with a laser beam with the body maintained in a stationary position.

36.-37. (cancelled)

38. A method of providing a mark on a power transmission belt having a body with a length and exposed laterally spaced side surfaces, each said side surface including a portion to engage a cooperating pulley, said method comprising the step of:

altering at least one of the laterally spaced side surfaces by forming an informational mark directly on the at least one laterally spaced side surface by an inscribing process to a depth of 0.1 to 1 mm at least partially on the portion of the at least one laterally spaced side surface.

39. The method of providing a mark on a power transmission belt according to claim 38 wherein the inscribing process defines a depression and further comprising the step of directing a material into the depression, which material contrasts with the at least one of the laterally spaced side surfaces.

40. A method of providing a mark on a power transmission belt having a body with a length and exposed laterally spaced side surfaces, said method comprising the steps of:

altering at least one of the laterally spaced side surfaces by forming a mark directly on the at least one laterally spaced side surface,

wherein the step of forming a mark on the at least one laterally spaced side surface comprises inscribing the mark on the at least one laterally spaced side surface,

wherein the mark is inscribed to a depth of 0.1 to 1 mm,

wherein the mark is inscribed with a laser beam,

wherein the laser beam forms a depression in the at least one of the laterally spaced side surfaces; and

directing a material into the depression, which material contrasts with the at least one laterally spaced side surface.

41. A method of providing a mark on a power transmission belt having a body with a length, exposed laterally spaced side surfaces, a cushion rubber layer within which at least one load carrying member is embedded, and a tension layer, said method comprising the step of:

altering at least one of the laterally spaced side surfaces by forming an informational mark directly on the at least one laterally spaced side surface by an inscribing process to a depth of 0.1 to 1 mm so that at least a part of the mark is formed on the at least one laterally spaced side surface in the tension layer and on the at least one load carrying member at the at least one laterally spaced side surface.

Evidence Appendix

Patent No.	Inventor	Date
4,997,994	Andrews	3/91
6,103,349	Matsumoto	8/00
DE29610216U1	(Germany)	9/96
JP10-252833A	(Japan)	9/98

All patent documents were relied upon by the Examiner for the grounds of rejection to be reviewed on appeal.

Related Proceedings Appendix

None

(19) BUNDESREPUBLIK DEUTSCHLAND

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(54) Vorrichtung für flexible Vorschubsteuerung unkonfektionierter Endlosbahnen zur Laserbeschriftung von Etiketten

DE 296 10 216 U 1

DE 296 10 216 U 1

"Vorrichtung für flexible Vorschubsteuerung unkonfektionierter Endlosbahnen zur Laserbeschriftung von Etiketten."

Die Erfindung betrifft eine flexible Vorrichtung für die Vorschubsteuerung unkonfektionierter Endlosbahnen zur Laserbeschriftung von Etiketten.

Bei derartigen bekannten Laserbeschriftungsgeräten werden die Schriftzeichen mittels partieller Oberflächenabtragung des mehrschichtigen Folienmaterials durch programmgesteuerte Laserstrahlführung erzielt, wodurch die Schriftzeichen durch stoffeigenen Farbkontrast gegenüber der unberührten Umgebung der Schriftzeichen deutlich und dauerhaft unempfindlich sichtbar sind.
Das so beschriftete abgemessene Schriftfeld ist dabei auf eine Trägerbahn temporär aufgeklebt und von da auf eine beliebige externe Zielfläche übertragbar.
/DGM 81 30 861; DGM 94 11 691; DE-PS 39 25 563/

Alternativ sind auch Bahn/Etiketten-Laser-Drucker bekannt, wobei das Druckwerk aus einer Druckwalze besteht, die über einen elektronisch gesteuerten Laserstrahl eine Bildübertragungswalze beschreibt, die sodann den auf ihr haftenden Toner auf die Schriftfläche abgibt, der anschließend in einer Fixierstation durch Wärmeeinwirkung verfestigt wird.
/PCT WO 91/19231/
Bei der sensorischen Erkennung der vorkonfektionierten Teilung der Beschriftungsfelder ist es jedoch für die exakte Position der Beschriftung notwendig, für die Bildwalze, die Entwicklereinheit sowie für die in einem Transportmodul zusammengefaßte Antriebswalze mit Andruckwalze einen völlig synchronen Antrieb zu installieren.
Im bezeichneten Beispiel des Standes der Technik ist diese Bedingung durch einen gemeinsamen Antriebsmotor realisiert.

Zur Steuerung des Vorschubes der Beschriftungs- oder Druckfelder weist der bekannte Stand der Technik somit auf zwei grundlegende Lösungen hin.
Entweder,
die Beschriftungsfelder oder das Trägermaterial der Beschriftungsfelder sind vorkon-

fektioniert. Dabei sind vorgefertigte einzelne Schriftfeldformate im vorbestimmten Endformat /geschnittene Etiketten/ auf eine Trägerbahn aufgebracht, wodurch das Vorschubintervall der Teilung der vorgefertigten Bahnlänge der Etiketten entspricht. Zur sensorischen Erkennung dieses Schriftfeldes dient dabei eine äußere Etikettenkante oder eine vorgefertigte Randmarkierung des Trägermaterials, etwa eine Randperforation.
Ein solcher Endlos-Bahnen/Etiketten-Laser-Drucker ist gem. PCT/WO 91/19231/ beschrieben.
oder,
es kommen sogenannte Schrittmotoren zum Einsatz, die den Vorschub der vorkonfektionierten oder unkonfektionierten Endlosbahn in einstellbaren, jedoch programmintern undisponiblen Schritten, mechanisch steuern und ausführen.

Die Nachteile dieses Standes der Technik sind vielfältig. So erfordert die Vorkonfektionierung der Endlosbahn, oder die Vorkonfektionierung und Aufbringung endformatiger Etiketten auf einer solchen endlosen Trägerbahn, erheblichen Vorfertigungsaufwand. Dieser Vorfertigungsaufwand schränkt die Anwendung dieses Verfahrens auf bestimmte Serienlosgrößen ein, indem nur relativ große Stückzahlen eines normativen Schriftfeldformates rationell herstellbar sind.
Die Freizügigkeit der Beschriftungsformate ist durch diese Vorrichtungen und Verfahren somit erheblich reduziert.
Außerdem sind solche vom Stand der Technik zum Einsatz gebrachte Schrittmotoren relativ teuer.
Bekannt wurde auch ein "COLOR PRINTER EMPLOYING FIDUCIAL MARK FOR REGISTRATION CORRECTION" mit einer punktgenauen Koordination des Bildes eines Colorprinters, einer systeminternen Marke und einem optischen Sensor zum Zwecke ortsidentischer Mehrfachbelichtung des photoreceptors. (XEROX DISCLOSURE JOURNAL, Vol.18, No. 3 May/June 1993)
Die hier erfindungsgemäß verwirklichte systeminterne, punktgenaue Detektion von Operationskoordinaten des Colorprinters und Bewegungskoordinaten des photoreceptors ist jedoch für eine flexible Beschriftung von Etiketten unkonfektionierter Endlosbahnen derart ungeeignet, daß sie grundsätzlich außer Betracht bleibt.

Aufgabe der Erfindung ist deshalb die Schaffung einer Vorrichtung zur flexiblen Vorschubsteuerung von Endlosbahnen zur Laserbeschriftung, die zur Steuerung des Vorschubes weder eine Vorkonfektionierung, noch einen Schrittmotor erfordern, und die

hohe und unkomplizierte Programmflexibilität für variable und einfach wählbare Beschriftungsformate aufweisen.
Erfindungsgemäß wird die Aufgabe dadurch gelöst, daß bei einer Vorrichtung für die flexible Vorschubsteuerung unkonfektionierter endloser Schriftbahnen zur Laserbeschriftung von Etiketten die Beschriftungsfelder der mehrschichtigen, endlosen Schriftbahn durch systeminterne Einzelmarkierung durch das Laserbeschriftungssystem erfolgt, indem die effektiven Beschriftungsfelder einer bestimmten Blocklänge der endlosen Schriftbahn durch vom Laserbeschriftungssystem eingebrachte Lasermarken markiert sind, und wobei die effektiven Beschriftungsfelder dadurch in Vorschubrichtung der endlosen Schriftbahn lagefixiert ist, daß zwischen den Lasermarken und dem Aufwickeldorn sensorische Mittel zur Erkennung der Lasermarken angeordnet sind und daß bei identischer Position von Lasermarken und Sensor eine exakte Steuergröße für den Antrieb des durch den Abstand zweier Lasermarken bestimmten Vorschubes des effektiven Beschrifzungsfeldes der endlosen Schriftbahn abgeleitet ist.

Wesentliches Merkmal der erfindungsgemäßen Lösung der Aufgabe ist ferner, daß die durch das Laserbeschriftungssystem in die endlose Schriftbahn eingebrachten Marken durch punktuelle Oberflächen-, Form-, oder Querschnittsänderungen der Schriftbahn gebildet sind, und vorzugsweise, daß diese eingebrachten Lasermarken durch vom Laser des Laserbeschriftungssystems eingebrachte punktuelle Löcher gebildet sind; und ferner, daß die Lasermarken unmittelbar außerhalb des effektiven Beschriftungsfeldes der endlosen Schriftbahn angeordnet sind.
Ferner besteht die Lösung der erfindungsgemäßen Aufgabe darin, daß die sensorischen Mittel zur Erkennung der Lasermarken außerhalb des Beschriftungsfeldes angeordnet sind, so daß der in Vorschubrichtung der Aufrollvorrichtung gemessene Abstand zweier Lasermarken die Position der effektiven Beschriftungsfelder, sowie den äußeren Abstand der effektiven Beschriftungsfelder zueinander, bestimmt.
Schließlich besteht ein wichtiges Merkmal der erfindungsgemäßen Lösung der Aufgabe darin, daß der Abstand zweier Lasermarken größer ist als die in Vorschubrichtung gemessene Länge des effektiven Beschriftungsfeldes.
Schließlich ist die Lösung der Aufgabe auch wesentlich dadurch gekennzeichnet, daß der Antrieb des Vorschubes der endlosen Schriftbahn mittels eines Synchronmotors mit Getriebe über Umlenkrollen sowie Auf- und Abwickeldorne erfolgt, so daß aufwendige Schrittmotoren verzichtbar sind.
In wesentlicher Folge der vorgenannten Merkmale besteht die vorteilhafte Lösung der

Aufgabe schließlich darin, daß die durch Einzelerkennung der Lasermarken durch die sensorischen Mittel gewonnenen Signale in Steuergrößen des Synchronmotors derart wandelbar sind, daß der Antrieb des Vorschubes der endlosen Schriftbahn mittels eines Synchronmotors mit Getriebe über Umlenkrollen sowie Auf- und Abwickeldorne unter Verzicht auf teuere Schrittmotoren erfolgt, und, daß die durch die sensorischen Mittel gewonnenen Signale in Steuerbefehle des Synchronmotors wandelbar sind, wobei der Aufwickeldorn vom Synchronmotor derart angetrieben ist, daß durch den Vorschub auf die endlose Schriftbahn ausschließlich Zugkräfte auftreffen.

Die erfindungsgemäße Vorschubsteuerung ist nachfolgend näher beschrieben.

Die dazugehörige Zeichnung zeigt eine beispielhafte Darstellung der erfindungsgemäßen Vorschubsteuerung.

Das auf dem Auf- und Abwickeldorn 3 bereitgestellte Folienmaterial der Schriftbahn 5 mit einer Rollenbreite von max 120 mm und einer Folienstärke zwischen etwa 0,1 und 0,25 mm hat Endlosformat und ist ohne Perforation der Seitenkanten.
Nach der manuellen Einbringung der Folie ist das potentielle Beschriftungsfeld 12 der endlosen Schriftbahn 5 über seitliche Führungsbuchsen 7 und Umlenkrollen 6 im Bereich des potentiellen Arbeitsfeldes 11 des Lasers positioniert. Aus dem Kreisquerschnitt des potentiellen Arbeitsfeldes 11 der Laseroptik resultiert das kleinere potentielle Beschriftungsfeld 12 mit dem darin eingeschlossenen rechteckigen effektiven Arbeitsfeld des Lasers 16, das durch das quasi identische effektive Beschriftungsfeld 17 mit der Blocklänge 8 vorgegeben ist.
Die Abtragung der Schriftzeichen im effektiven Beschriftungsfeld 17 erfolgt durch den programmgeführten Laser, wie an sich bekannt.
Bestandteil der Beschriftung ist die Einbringung einer programmgesteuerten Lasermarke 1 in die endlose Schriftbahn 5 innerhalb der Blocklänge 8, jedoch in eine unmittelbar außerhalb einer Längskante des effektiven Beschriftungsfeldes 17 fixierten Position des potentiellen Beschriftungsfeldes 12.
Diese Lasermarke 1 stellt eine Oberflächen-, Form- oder Querschnittsveränderung der endlosen Schriftbahn 4 derart dar, daß sie von einem in Vorschubrichtung 10 angeordneten Sensor 2 erkannt und in Signale wandelbar ist, die den über Zahnscheiben 13 und Zahnriemen 14 installierten Antrieb des Synchronmotoers 9 stoppen, nachdem der programmgesteuerte Start des Antriebes in Vorschubrichtung 10 eine kongruente

Position von Lasermarke 1 und Sensor 2 hergestellt hat.
In beispielhafter Ausführung der erfindungsgemäßen Lasermarke 1 ist in der dazugehörigen Zeichnung ein durchgängiges Laserloch dargestellt.
Es ist naheliegend, auch andere, adäquate Markierungen zu verwenden, sofern sie nur der Sensibilität des erfindungsgemäßen Sensors 2, der Flexibilität des Vorschubs variabler Beschriftungsfelder und der notwendigen Maßgenauigkeit der Laserbeschriftung von Etiketten genügen.
Dem dargestellten Erfindungsprinzip, der "variabel wählbaren Markierung im fortlaufenden Prozeß", ist schließlich auch dann entsprochen, wenn an die Stelle der Lasermarke 1 etwa mechanische Mittel treten, die die Folie punktuell ausreichend deutlich verändern.
Die Position der Lasermarke 1 innerhalb der Blocklänge 8 des effektiven Beschriftungsfeldes 17 ist dabei zweckmäßig so gewählt, daß der Abstand 15 zweier Lasermarken 1 größer ist als die Blocklänge 8 des effektiven Beschriftungsfeldes 17.
Dadurch ist es möglich, einen erforderlichen axialen Abstand der Beschriftungsblöcke untereinander zu gewährleisen.
Im Ausführungsbeispiel der Erfindung gemäß Zeichnung ist die Blocklänge 8 in maximaler Länge des effektiven Beschriftungsfeldes 17 dargestellt. Es ist ohne weiteres möglich, diese dargestellte Blocklänge 8 in eine Anzahl beliebig kürzerer Blocklängen 8 aufzuteilen und durch entsprechende Plazierung der Lasermarkierung zu steuern.
Mit der erfindungsgemäßen Vorrichtung ist somit unter Einbeziehung des unkonfektionierten Beschriftungsmaterials und des Beschriftungswerkzeugs selbst eine einfache, sichere und überaus flexible Vorschubsteuerung des effektiven Beschriftungsfeldes realisiert.

Der Abstand 15 zweier Lasermarken 1 ist gemäß dazugehöriger Zeichnung durch den axialen Abstand von Sensor 2 und Lasermarke 1 deutlich.
Bei einer anderen Darstellung des Abstandes 15 zweier Lasermarken 1 im Ausführungsbeispiel der dazugehörigen Zeichnung ist in Vorschubrichtung 10 die Umlenkrolle 6 zwischengeschaltet, um die weitere Anordnung von Lasermarken 1 prinzipiell anzugeben.

Gleichzeitig ist es durch die Plazierung der Lasermarke 1 möglich, den Grad der Ausnutzung des endlosen Beschriftungsfeldes 4 programmintern zu bestimmen und, im Gegensatz zu einer vorkonfektionierten endlosen Schriftbahn 5 des Standes der Technik, Größe und Position der Beschriftung freizügig zu disponieren.
Durch die erfindungsgemäße Vorrichtung ist somit unter Anwendung des unkonfektionierten Beschriftungsfeldes und des programmgeführten Beschriftungslasers eine einfache, sichere und flexible Vorschubsteuerung realisiert, die auch die qualitativen Anforderungen

der Laserbeschriftung vollständig erfüllt. Die hohe Freizügigkeit der Vorschubsteuerung gegenüber konfektionierten Schriftbahnen macht ihren Einsatz auch besonders wirtschaftlich möglich.

Bezugszeichenverzeichnis

1 Lasermarke
2 Sensor
3 Auf- oder Abwickeldorn
4 Beschriftungsfeld der endlosen Schriftbahn
5 Endlose Schriftbahn
6 Umlenkrollen
7 Seitliche Führungsbuchsen
8 Blocklänge des effektiven Beschriftungsfeldes
9 Synchronmotor
10 Vorschubrichtung der endlosen Schriftbahn
11 Potentielles Arbeitsfeld des Lasers
12 Potentielles Beschriftungsfeld
13 Zahnscheibe
14 Zahnriemen
15 Abstand zweier Lasermarken
16 Effektives Arbeitsfeld des Lasers
17 Effektives Beschriftungsfeld

Schutzansprüche:

"Vorrichtung für flexible Vorschubsteuerung unkonfektionierter Endlosbahnen zur Laserbeschriftung von Etiketten"

1. Vorrichtung für flexible Vorschubsteuerung unkonfektionierter endloser Schriftbahnen (5) zur Laserbeschriftung von Etiketten, wobei die Beschriftungsfelder (4) der mehrschichtigen, endlosen Schriftbahn (5) durch systeminterne Einzelmarkierung der Beschriftungsfelder (4) durch das Laserbeschriftungssystem gekennzeichnet sind, indem die effektiven Beschriftungsfelder (17) einer Blocklänge (8) der endlosen Schriftbahn (5) durch vom Laserbeschriftungssystem eingebrachte Lasermarken (1) markiert sind, und wobei die effektiven Beschriftungsfelder (17) dadurch in Vorschubrichtung (10) der endlosen Schriftbahn (5) lagefixiert sind, daß zwischen den Lasermarken (1) und dem Aufwickeldorn (3) sensorische Mittel (2) zur Erkennung der Lasermarken (1) angeordnet sind und daß bei kongruenter Position von Lasermarken (1) und Sensor (2) eine Steuergröße für den Antrieb des durch den Abstand (15) zweier Lasermarken (1) bestimmten schrittweisen, flexiblen Vorschubes des effektiven Beschriftungsfeldes (17) der endlosen Schriftbahn (5) abgeleitet ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet**, daß die durch das Laserbeschriftungssystem in die endlose Schriftbahn (5) eingebrachten Lasermarken (1) durch punktuelle Oberflächen-, Form-, oder Querschnittsänderungen der endlosen Schriftbahn (5) gebildet sind.

3. Vorrichtung nach den Ansprüchen 1 und 2, **dadurch gekennzeichnet,** daß die in die endlose Schriftbahn (5) eingebrachten Lasermarken (1) durch vom Laser eingebrachte punktuelle Löcher gebildet sind.

4. Vorrichtung nach den Ansprüchen 1 bis 3, **dadurch gekennzeichnet,** daß die Lasermarken (1) unmittelbar außerhalb des effektiven Beschriftungsfeldes (17) der endlosen Schriftbahn (5) angeordnet sind.

5. Vorrichtung nach den Ansprüchen 1 bis 4, **dadurch gekennzeichnet,** daß die sensorischen Mittel (2) zur Erkennung der Lasermarken (1) unmittelbar außerhalb des effektiven Beschriftungsfeldes (17), jedoch innerhalb der Blocklänge (8) des effektiven Beschriftungsfeldes (17) im potentiellen Beschriftungsfeld (12) angeordnet sind, so daß der in Vorschubrichtung (10) der Aufrollvorrichtung (3) gemessene Abstand (15) zweier Lasermarken (1) die Positionen der effektiven Beschriftungsfelder (17), sowie den äußeren Abstand der effektiven Beschriftungsfelder (17) zueinander, bestimmt.

6. Vorrichtung nach den Ansprüchen 1 bis 5, **dadurch gekennzeichnet,** daß der Abstand (16) zweier Lasermarken (1) größer ist als die in Vorschubrichtung (10) gemessene Länge des effektiven Beschriftungsfeldes (17).

7. Vorrichtung nach den Ansprüchen 1 bis 6, **dadurch gekennzeichnet**, daß der Antrieb des Vorschubes der endlosen Schriftbahn (5) mittels eines Synchronmotors (9) mit Getriebe über Umlenkrollen (6) sowie Auf- und Abwickeldorne (3) erfolgt.

8. Vorrichtung nach den Ansprüchen 1 bis 7, **dadurch gekennzeichnet**, daß die durch Einzelerkennung der Lasermarken (1) durch die sensorischen Mittel (2) gewonnenen Signale in Steuergrößen des Synchronmotors (9) wandelbar sind.

9. Vorrichtung nach den Ansprüchen 1 bis 8, **dadurch gekennzeichnet**, daß der freie Anfang der endlosen Schriftbahn (5) im Aufwickeldorn (3) befestigt ist und daß der Aufwickeldorn (3) vom Synchronmotor (9) derart angetrieben ist, daß durch den Vorschub auf die endlose Schriftbahn (5) ausschließlich Zugkräfte auftreffen.

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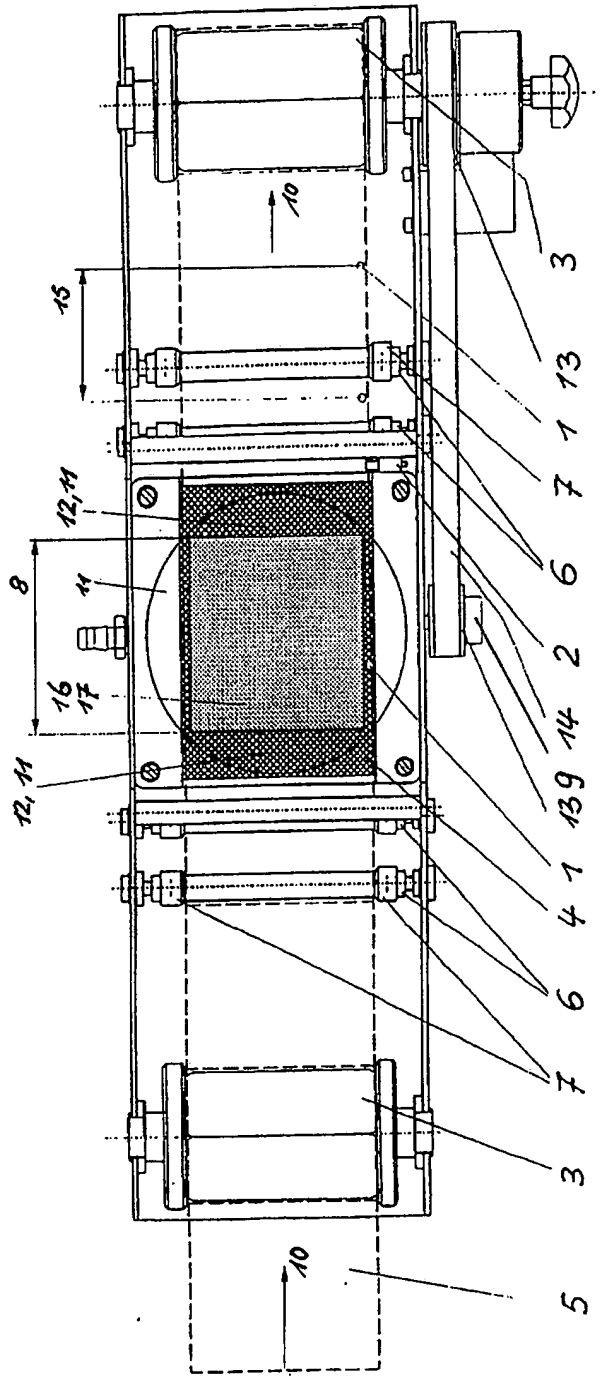

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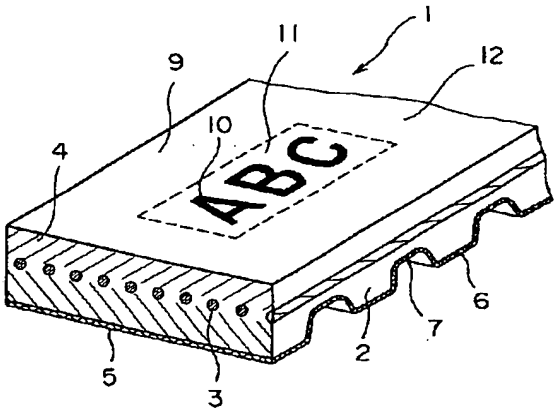
(54)【発明の名称】　マーク付き動力伝動ベルトとマーク刻印方法

(57)【要約】

【課題】　ベルト背面が背面駆動面に使用されても鮮明なマークを残存ざせ、しかもマークを付けた領域もそうでない領域も段差のない平坦面を維持して背面駆動面の騒音を減少させ、またレーザ光の照射によるベルトの機械的特性を悪化させないマーク付き動力伝動ベルトとマーク刻印方法を提供する。

【解決手段】　プーリに当接して駆動面となる背面９にマーク１０を設けた動力伝動ベルト１であり、上記背面９にはレーザ光を照射して得られたマーク１０が刻印され、マークの存在する領域１１が他の領域と段差もなく平坦面を維持している。



【特許請求の範囲】
【請求項１】　プーリに当接して駆動面となる背面にマークを設けた動力伝動ベルトにおいて、上記背面にはレーザ光を照射して得られたマークが刻印され、マークの存在する領域が他の領域と段差もなく平坦面を維持していることを特徴とするマーク付き動力伝動ベルト。
【請求項２】　刻印されたマークの深さが０．１～１ｍｍである請求項１記載のマーク付き動力伝動ベルト。
【請求項３】　マークを刻印する背面がゴム層で形成されている請求項１または２記載のマーク付き動力伝動ベルト。
【請求項４】　刻印したマークの窪みに背面と異なる色を有する塗料を付着した請求項１、２または３記載のマーク付き動力伝動ベルト。
【請求項５】　マークが心線を埋設した背面ゴム層と、所定の間隔で設けた歯部とから形成される歯付ベルトの背面ゴム層に刻印されている請求項１、２、または３記載のマーク付き動力伝動ベルト。
【請求項６】　マークが平ベルトの背面ゴム層に刻印されている請求項１、２、または３記載のマーク付き動力伝動ベルト。
【請求項７】　プーリに当接して駆動面となる背面にマークを設けた動力伝動ベルトのマーク刻印方法において、レーザ光を少なくとも１つのスキャンミラーによって反射角度を調節しながら上記背面のゴム層に照射してマークを刻印し、ゴム層に埋設した繊維部材を損傷させないようにしたことを特徴とする動力伝動ベルトのマーク刻印方法。
【請求項８】　心線を埋設した背面ゴム層と、所定の間隔で設けた歯部とから形成される歯付ベルトの背面ゴム層に、深さ０．１～１ｍｍのマークを刻印した請求項７記載の動力伝動ベルトのマーク刻印方法。
【請求項９】　レーザ光の照射中、動力伝動ベルトを静止させる請求項７または８記載の動力伝動ベルトのマーク刻印方法。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明はマーク付き動力伝動ベルトとマーク刻印方法に係り、詳しくは歯付ベルト、平ベルト、Ｖリブドベルトなどの動力伝動ベルトにおいて、プーリを当接させて駆動面として使用する背面に、ベルトの構成部材を致命的に損傷させずに、マークを刻設し、他の領域と段差もなく平坦面を維持して、騒音の少ない背面駆動を可能にし、そしてマークが鮮明で常に読み取りができるマーク付き動力伝動ベルトとマーク刻印方法に関する。
【０００２】
【従来の技術】従来の動力伝動ベルトの背面にマークを付ける方法として、マークとなる未加硫カラーゴムを透明な合成樹脂フィルムの基材上に付着させた転写マークを、成形ドラムに貼着した後、ゴム付カバー帆布を嵌挿し、伸張ゴム層、心線そして圧縮ゴム層を巻付け、次いでこれにジャケットを嵌挿して加硫し、加硫したベルトスリーブから転写マークのフイルムをはぎとることでゴム付カバー帆布の表面にマークを転写していた。
【０００３】しかし、加硫中、基材および基材から隆起した転写マークのゴムがベルトスリーブの背面に圧入されるため、背面には基材をはぎとった後の段差パターンが形成されてマークのある領域がわずかに窪んだ状態になった。ベルト背面にはマークを転写した領域としない領域との間に段差が生じて平坦な面にならなかった。最近のＶリブドベルトは自動車の補機駆動用として使用され、特に多軸駆動でサーペンティーン状に巻き付けられるとともに、ベルト背面にはテンショナーを係合させるために、このようなベルト背面に凹凸面があると前記テンショナーは振動し騒音を発していた。そればかりでなく、ベルト背面を使用するベルト背面駆動でも、ベルト駆動時の騒音が大きくなる問題があった。
【０００４】このため、特公平７－９６３３０号公報には、基材の上にマークを付着させた転写マーク材と未加硫ゴムを含んだ帆布とを、該マークが帆布に面するように重ね合わせ、これを加熱加圧した後に基材を剥離して該マークを予め帆布に転写しておき、この帆布をベルトの成形時に使用する方法が開示され、また特開平８－１５２０４８号公報には、不織布の基材の上にマークを付着させたマーク材をベルトのカバー帆布に付着させ、マーク材とカバー帆布とを一体にする方法が提案されている。
【０００５】また、最近では、マーク材を使用せずに、インクジェットプリンタを用いて直接ベルト背面にマークを印刷する方法が、特開平７－２３３９９２号公報に開示されている。これは、インクジェットプリンタにより、ベルト背面に直接にインクを噴射することでマークを印刷するものであり、具体的にはベルトスリーブから一定幅に切断したものを用意し、これをベルト支持台上に一定数並べて固定し、この支持台を所定位置へ移動させ、インクジェットプリンタを動作させ、そのインクヘッドよりインクを上記ベルトに向けて噴射し、所望のマークを印刷する方法である。
【０００６】
【発明が解決しようとする課題】しかし、ベルト背面にマークを転写したり、転写マーク材をベルトと一体にする方法では、マークの付いたベルト背面をプーリに当接させて駆動面として使用する場合には、マークがプーリによって擦られて消えやすくなり、せっかくの製造マーカー、商品名、製造年月、製造ロットＮｏ．を含むマークも、ベルト走行後間もなく判読不能になるといった問題があった。また、インクジェットプリンタを用いて直接ベルト背面にマークを印刷する方法でも、プーリがベルト背面を均一に摩耗するために、マークが消えてしま

う問題があった。

【０００７】本発明はこのような問題点を改善するもので、ベルト背面が駆動面として使用されても鮮明なマークを残存ざせ、しかもマークを付けた領域もそうでない領域も段差のない平坦面を維持して背面駆動面の騒音を減少させ、またレーザ光の照射によるベルトの機械的特性を悪化させないマーク付き動力伝動ベルトとマーク刻印方法を提供することを目的とする。

【０００８】

【課題を解決するための手段】上記課題を解決するため、本発明のうち請求項１に係る発明は、プーリに当接して駆動面となる背面にマークを設けた動力伝動ベルトにおいて、上記背面にはレーザ光を照射して得られたマークが刻印され、マークの存在する領域が他の領域と段差もなく平坦面を維持しているマーク付き動力伝動ベルトであり、ベルト背面が駆動面に使用されても、この面に所定の深さに刻印されたマークはベルト走行後間も消えることがない。

【０００９】請求項２に係る発明は、刻印されたマークの深さが０．１～１ｍｍであるため、心線や帆布等の繊維部材が照射したレーザ光により切断されることはなく、ベルトの機械的特性も悪影響をうけることがない。

【００１０】請求項３に係る発明は、マークを刻印する背面がゴム層で形成されているマーク付き動力伝動ベルトにあり、ゴム層に刻印したマークの窪みから亀裂の発生が起こりにくく、またマークを刻印するときにも帆布等の部材がレーザ光により切断されることがなく、ベルトの機械的特性も変化しない。

【００１１】請求項４に係る発明は、刻印したマークの窪みに背面と異なる色を有する塗料を付着したマーク付き動力伝動ベルトであり、マークパターンが一層鮮明になる。

【００１２】請求項５に係る発明は、マークが心線を埋設した背面ゴム層と、所定の間隔で設けた歯部とから形成される歯付ベルトの背面ゴム層に刻印されている歯付ベルトに適用することができる。

【００１３】請求項６に係る発明は、マークが平ベルトの背面ゴム層に刻印されている平ベルトに適用することができる。い。

【００１４】請求項７に係る発明は、プーリに当接して駆動面となる背面にマークを設けた動力伝動ベルトのマーク刻印方法において、レーザ光を少なくとも１つのスキャンミラーによって反射角度を調節しながら上記背面のゴム層に照射してマークを刻印し、ゴム層に埋設した繊維部材を損傷させないようにした動力伝動ベルトのマーク刻印方法にあり、マークの深さを調節することによって、心線や帆布等の繊維部材に致命的な損傷を与えず刻印することができ、また背面がたとえ駆動面に使用されても、この面に所定の深さに刻印されたマークはベルト走行後間も消えることがない。

【００１５】請求項８に係る発明は、心線を埋設した背面ゴム層と、所定の間隔で設けた歯部とから形成される歯付ベルトの背面ゴム層に、深さ０．１～１ｍｍのマークを刻印した動力伝動ベルトのマーク刻印方法にあり、心線に致命的な損傷を与えず刻印することができ、レーザ光照射後のベルトの機械的特性を低下させることはない。

【００１６】請求項９に係る発明は、レーザ光の照射中、動力伝動ベルトを静止させる動力伝動ベルトのマーク刻印方法である。

【００１７】

【発明の実施の形態】以下に本発明の実施形態の図を用いて説明する。図１は本発明に係るマーク付き動力伝動ベルトの一つである歯付ベルトの断面斜視図であり、歯付ベルト１はベルト長手方向に沿って複数の歯部２と、心線３を埋設した背部４、そして歯部表面６および歯底部７の表面を被覆した歯布５とからなっている。

【００１８】前記歯部２及び背部４に使用されるゴムは、水素化ニトリルゴムを始めとして、クロロスルホン化ポリエチレン（ＣＳＭ）、アルキル化クロロスルホン化ポリエチレン（ＡＣＳＭ）、クロロプレンゴムなどの耐熱老化性の改善されたゴムが好ましい。水素化ニトリルゴムは水素添加率が８０％以上であり、耐熱性及び耐オゾン性の特性を発揮するためには９０％以上が良い。水素添加率８０％未満の水素化ニトリルゴムは、耐熱性及び耐オゾン性は極度に低下する。上記ゴムの中には配合剤として、カーボンブラック、亜鉛華、ステアリン酸、可塑剤、老化防止剤等が添加され、また加硫剤として硫黄、有機過酸化物があるが、これらの配合剤や加硫剤は、特に制限されない。

【００１９】上記心線３としては、Ｅガラスまたは高強度ガラスの５～９μｍのフィラメントを撚り合わせたものを、ゴムコンパウンドからなる保護剤あるいは接着剤であるＲＦＬ液等で処理されたものである。また、有機繊維としては応力に対して伸びが小さく、引張強度が大きいパラ系アラミド繊維（商品名：ケブラー、テクノーラ）の０．５～２．５デニールのフィラメントを撚り合わせ、ＲＦＬ液、エポキシ溶液、イソシアネート溶液とゴムコンパウンドとの接着剤で処理された撚りコードが使用される。しかし、本発明ではこれらに限定されることはない。上記心線３の直径は、０．６～１．１０ｍｍの範囲設定されるが、０．６ｍｍ未満では心線３の引張強さが低く、高負荷伝動に耐えることができない。一方、１．１０ｍｍを越えると、ベルト寸法上成立しない。

【００２０】歯布５として用いられる帆布は、６ナイロン、６６ナイロン、ポリエステル、アラミド繊維等であって、単独あるいは混合されたものであってもよい。歯布５の経糸（ベルト幅方向）や緯糸（ベルト長さ方向）の構成も前記繊維のフィラメント糸または紡績糸であ

り、織構成も平織物、綾織物、朱子織物でいずれでもよい。なお、緯糸には伸縮性を有するウレタン弾性糸を一部使用するのが好ましい。

【００２１】上記歯布５は、ＲＦＬ液、イソシアネート溶液あるいはエポキシ溶液によって処理される。ＲＦＬ液は、レゾルシンとホルマリンとの初期縮合物をラテックスに混合したものであり、ここで使用するラテックスとしてはスチレン．ブタジエン．ビニルピリジン三元共重合体、水素化ニトリルゴム、クロロスルフォン化ポリエチレン、エピクロルヒドリンなどのラテックスである。

【００２２】しかして、本発明の歯付ベルト１においては、背部４はゴム層からなり、その外表面である背面９は、プーリに当接する駆動面になり、商標、製造年月、ロット番号、グレード等に代表されるマーク１０を刻印している。刻印されたマーク１０は、後述するようにレーザ光を照射して得られたものであり、その深さは０．１～１ｍｍで、ベルトの引張り強さ等の機械的特性に影響を与える上で重要になり、０．１ｍｍ未満では背面４の摩耗が進行するとマーク１０が消える可能がある。一方、１ｍｍを超えると、レーザ光が背部４に埋設している心線３に熱的な悪影響を及ぼす危険性があり、またゴミ等がマーク１０の窪みに溜まりやすく、走行中に溜まったゴミが放出されて他の機材を汚染する可能性がある。また、マーク１０の文字の幅も０．１～１ｍｍであるが、これは任意に調節可能である。

【００２３】背面９に刻印されたマーク１０の存在する領域１１は平坦であり、かつそれ以外の領域１２との境界部にも段差もなく平坦になっており、背面９に当接するプーリが振動することなく、これに伴う振動騒音も発生しなくなる。

【００２４】図２は本発明に係る平ベルト１３の断面斜視図であり、該ベルト１３が内部にロープ等の心線３をゴム層１４中に埋設した構造からなり、背面１５はプーリを当接させる駆動面になっている。この背面１５はゴム層１４のみからなり、商標、製造年月、ロット番号、グレード等に代表される種々のマーク１０を刻印している。

【００２５】上記歯付ベルト１や平ベルト１３の刻印したマーク１０の窪みに、背面９、１５と異なる色を有する塗料を付着することも可能であり、このようにすればマークのパターンが一層鮮明になる。

【００２６】上記のレーザ光を照射してマークを刻印する方法は、図３に示すようにレーザ発振部２０から発振したCO_2 レーザ光等の印字用レーザ光２１を集光レンズ２２に集めて表面でレーザスポットが最小になるようし、制御部２３によってスキャンミラー２４を走査させてレーザ光２１の反射角度を調節しながら移動可能な支持台２５上に設置されたベルト１、１３の背面９、１５に照射して所定範囲内でマーク１０を刻印する。これは表面を焼き付けるという原理に似ており、照射したレーザ光２１は背面９、１５のごく一部のゴムを瞬時に溶かして気化させ、窪み２７を形成する。

【００２７】所定範囲外のマークを刻印する場合には、支持台２５を平行に一軸方向へ移動させた後、再度レーザ光２１を照射して新たなマーク１０を刻印する。即ち、Ａ、Ｂ、Ｃの３文字が最大範囲であれば、支持台２５を移動した後に、他の文字を刻印する。

【００２８】このレーザ光２１は、予め文字、記号、図形等のデータを入力した制御部２３が入力したプログラムにしたがって自動的にスキャンミラー２４を走査し、かつレーザ光２１のＯＮ、ＯＦＦを制御することにより入力した所望の文字、記号、図形を描くことができる。ベルトの背面９、１５とスキャンミラー２４の距離が１００～１５０ｍｍ程度と比較的短いため、強いレーザ光２１を長時間照射する必要もないため、ベルトの構成部材、例えば心線等が熱により損傷することもない。

【００２９】図４はベルト１、１３の背面９、１５にレーザ光２１を照射して所定範囲内でマーク１０を刻印している状態を示しており、０．１～１ｍｍの深さをもったマーク１０の窪み２７が刻印されている。これにより、心線３の繊維部材に致命的な損傷を与えず刻印することができる。

【００３０】尚、上記のレーザ光２１を使用してマーク１０を刻印するに際しては、直接ゴム層の表面に照射する場合には、ベルトの引張強さ等の機械的特性を変化させないが、帆布面にレーザ光２１を照射すると、帆布の構成糸を切断、損傷させることになり、これはベルトの機械特性を低下を招くので、好ましくない。

【００３１】

【実施例】以下、本発明を実施例にて詳細に説明する。

実施例１

１４０デニールの６６ナイロンの経糸と、２８０デニールの６６ナイロンと１４０デニールのウレタン弾性糸からなる緯糸によって織物を製織した後、織物を水中で振動を与えて製織時の幅の約１／２幅まで収縮させた後、水素化ニトリルゴム組成物からなるゴム糊に浸漬、乾燥し、更に水素化ニトリルゴム組成物のゴムシートを上記織物に圧着して歯布とした。

【００３２】次に、心線として素線径９μｍのＥガラスフィラメントを所定本数引き揃えて、保護剤および接着剤であるＲＦＬ液に浸漬し、乾燥後、下撚りを行って子縄とし、その子縄を所定本数引き揃えて下撚りとは逆方向に上撚りを施してＳ、Ｚ一対の撚りコードを作製した。

【００３３】各歯布をエンドレス状の筒状体に仕上げ、これを金型にセットした。その上からＳ、Ｚ一対のコードを交互に巻き付け、その上に水素化ニトリルゴム組成物の圧延シートを巻き付け、通常の圧入による加硫方法によって加硫後、加硫スリーブを所定の幅に切断して個

々のベルトを作製した。ベルトサイズは、歯数：１０５、ベルト幅：１９．１mm、歯ピッチ：８mmで、ベルトの歯型はＳＴＰＤであった。

【００３４】次に、図3に示すような装置を使用し、レーザ発振部から発振したCO_2 レーザ光（１２W、クラス4、波長１０．６μm）を集光レンズに集め、制御部と連結したスキャンミラーを２軸へ走査させ、スキャンミラーとの距離を１３０mmに調節した支持台上のベルトの背面に照射し、表面に深さ０．５mmのマークを刻印した。

【００３５】一方、マークを刻印しないベルトとして、インクジェットプリンタを用いてベルト背面に直接マークを印刷したものを使用した。

【００３６】マークを刻印した歯付ベルトとインクジェットプリンタによりマークを印刷した歯付ベルトを、多軸屈曲走行試験機に装着して走行させ、各ベルトの寿命に至ったときのマーク消失の有無を調べた。その結果を表1に示す。

【００３７】上記多軸屈曲走行試験機３０は、図5に示すように駆動プーリ３１（歯数２４）と、2つの固定した従動プーリ３２、３３（各歯数２４）と1つの移動可能な従動プーリ３４（歯数２４）を相対向して配置し、各プーリ間にプーリ径３２mmφのアイラープーリ３５、３６、３７、３８を置いたものである。そして、走行条件としては、雰囲気環境温度１００°Ｃ、軸荷重６０ｋｇｆ、駆動プーリ１６の回転数５５００ｒｐｍである。

【００３８】また、マークを刻印した歯付ベルトとマークを印刷した歯付ベルトを、３軸耐熱走行試験に取り付けて走行し、走行後のベルトの引張強さを測定した。

【００３９】この３軸耐熱走行試験４０は、図6に示すように駆動プーリ４１（歯数２１）と、従動プーリ４２（歯数４２）、そしてテンションプーリ４３（プーリ径５２mmφ）からなる。ベルトを駆動プーリ４１と、従動プーリ４２に巻き付け、そしてベルト背面をテンションプーリ４３に係合し、１２０°Ｃの雰囲気環境温度で駆動プーリ４１の回転数７，２００ｒｐｍ、従動プーリ４２に負荷５ｐｓ、ベルト初張力１５ｋｇで走行させた。そして、５００時間走行後のベルトの引張強さを測定した。その結果を表１に示す。

【００４０】

【表１】

	マークを刻印した歯付ベルト	マークを印刷しない歯付ベルト
多軸屈曲走行による走行寿命（時間）	４３５	４３０
多軸屈曲走行によるマーク消失の有無	無	多く有
３軸耐熱走行試験後のベルトの引張強さ（Kg / ベルト幅19.1mm）	９６０	１０９０

【００４１】この結果よると、マークを刻印した歯付ベルトは、ベルトの寿命までマークの消失がなく、また走行後のベルトの引張強さもマークを印刷した歯付ベルトに比べて差がないことから、レーザ光の照射によりベルトの機械特性が低下していないことが判る。しかし、マークを印刷した歯付ベルトは走行時間中にマークが消失し始めており、ベルトの寿命の時にはマークが部分的に消失していた。

【００４２】

【発明の効果】以上のように、本発明のうち請求項１に係る発明は、プーリに当接して駆動面となる背面にマークを設けた動力伝動ベルトにおいて、上記背面にはレーザ光を照射して得られたマークが刻印され、マークの存在する領域が他の領域と段差もなく平坦面を維持しているマーク付き動力伝動ベルトであり、ベルト背面が駆動面に使用されても、この面に所定の深さに刻印されたマークはベルト走行後間も消えることがない。

【００４３】請求項２に係る発明は、刻印されたマークの深さが０．１～１mmであるため、心線や帆布等の繊維部材が照射したレーザ光により切断されることはなく、ベルトの機械的特性も悪影響をうけることがない。

【００４４】請求項３に係る発明は、マークを刻印する背面がゴム層で形成されているマーク付き動力伝動ベルトにあり、ゴム層に刻印したマークの窪みから亀裂の発生が起こりにくく、またマークを刻印するときにも帆布等の部材がレーザ光により切断されることがなく、ベルトの機械的特性も変化しない。

【００４５】請求項４に係る発明は、刻印したマークの窪みに背面と異なる色を有する塗料を付着したマーク付き動力伝動ベルトであり、マークのパターンが一層鮮明になる。

【００４６】請求項５に係る発明は、マークが心線を埋設した背面ゴム層と、所定の間隔で設けた歯部とから形成される歯付ベルトの背面ゴム層に刻印されている歯付ベルトに適用することができる。

【００４７】請求項６に係る発明は、マークが平ベルト

の背面ゴム層に刻印されている平ベルトに適用することができる。い。

【００４８】請求項７～９に係る発明は動力伝動ベルトのマーク刻印方法であり、レーザ光を少なくとも１つのスキャンミラーによって反射角度を調節しながら上記背面のゴム層に照射して、マークを刻印してゴム層に埋設した繊維部材を損傷させないようにした動力伝動ベルトのマーク刻印方法にあり、マークの深さを０．１～１ｍｍに調節することによって、心線や帆布等の繊維部材に致命的な損傷を与えず刻印することができ、またベルト背面がたとえ駆動面に使用されても、この面に所定の深さに刻印されたマークはベルト走行後間も消えることがない。

【図面の簡単な説明】

【図１】本発明に係るマーク付き動力伝動ベルトの一つである歯付ベルトの断面斜視図である。

【図２】本発明に係る平ベルトの断面斜視図である。

【図３】レーザ光を照射してマークを刻印する方法を示す図である。

【図４】レーザ光を歯付ベルトの背面に照射してマークを刻印している状態を示す図である。

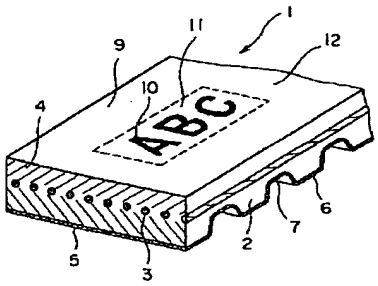
【図５】多軸屈曲走行試験機の概略図である。

【図６】３軸耐熱走行試験の概略図である。

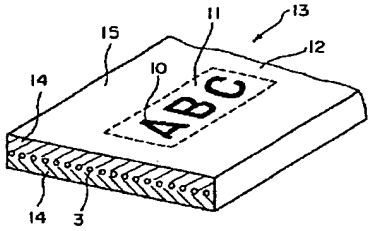
【符号の説明】

１　歯付ベルト
９　背面
１０　マーク
１１　マークの存在する領域
１３　平ベルト
１５　背面
２０　レーザ発振部
２１　レーザ光
２２　集光レンズ
２３　制御部
２４　スキャンミラー

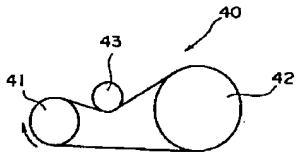
【図１】



【図２】

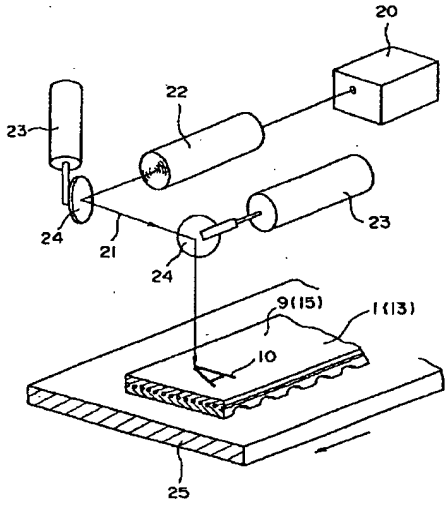


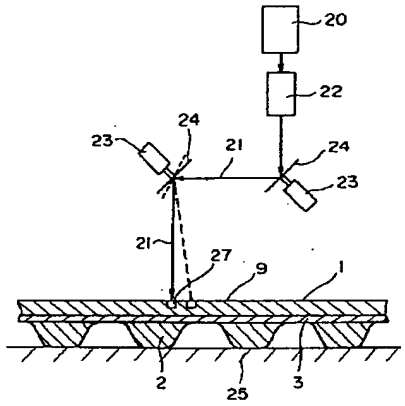
【図６】



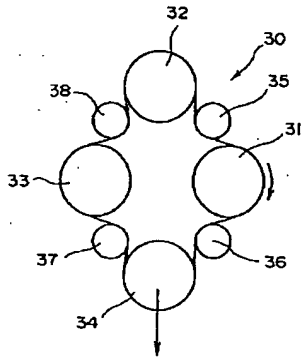
【図４】

【図３】





【図５】



PATENT ABSTRACTS OF JAPAN

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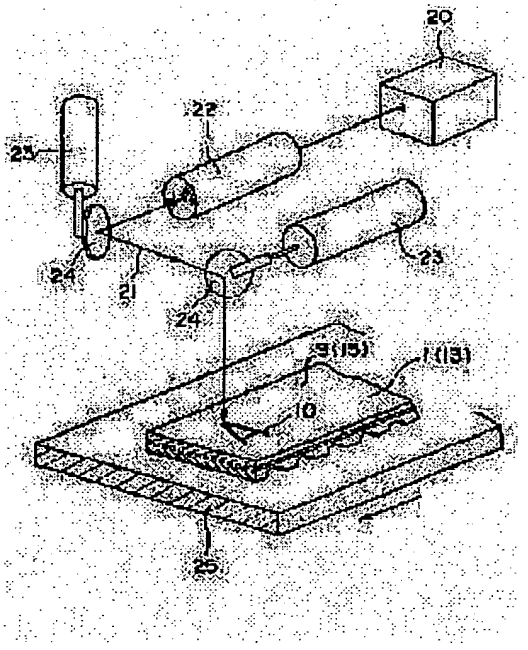
(54) MOTIVE POWER TRANSMITTING BELT HAVING MARK AND MARK STAMPING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To leave a clear mark even if a belt back face is used as a driving surface, and prevent the deterioration of a mechanical characteristic of a belt by stamping the mark by irradiating a painting laser beam to the back face becoming the driving surface.

SOLUTION: A printing laser beam 21 oscillated from a laser oscillating part 20 is condensed to a condenser lens 22, and a laser spot is minimized on a surface, and a scan mirror 24 is scanned by a control part 23, and while adjusting an angle of reflection of the laser beam 21, it is irradiated to a back face 9(15) of a belt 1(13) arranged on a movable support stand 25, and a mark 10 is stamped in a prescribed range. This resembles the principle of printing a surface, and the irradiated laser beam 21 instantly melts and gasifies a very small part of the back face 9(15), and forms a recess. Since there is no need to irradiate a strong lase beam 21 for many hours, a constitutive member of the belt, for example, a conductor or the like is not damaged by heat.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a power transmission belt with a mark, and the mark stamp approach, and is set in detail to power transmission belts, such as a belt with a gear tooth, a flat belt, and V ribbed belt. Without damaging the configuration member of a belt fatally, in the tooth back which a pulley is made to contact and is used as a drive side, engrave a mark, other fields and level differences cannot be found, either, and a flat side is maintained at it. The tooth-back drive with little noise is enabled, and it is related with the power transmission belt with a mark whose reading whose mark is clear and is always possible, and the mark stamp approach.
[0002]
[Description of the Prior Art] The imprint mark to which the non-vulcanized color rubber used as a mark was made to adhere on the base material of a transparent synthetic-resin film as an approach of attaching a mark to the tooth back of the conventional power transmission belt After sticking on a shaping drum, the mark was imprinted on the front face of covering sail cloth with rubber by fitting in covering sail cloth with rubber, twisting an elongation rubber layer, core wire, and a compression rubber layer, fitting in a jacket, vulcanizing subsequently to this, and stripping the film of an imprint mark from the vulcanized belt sleeve.
[0003] However, during vulcanization, since the rubber of the imprint mark which upheaved from the base material and the base material was pressed fit in the tooth back of a belt sleeve, the field which the level difference pattern after stripping a base material is formed in a tooth back, and has a mark changed into the condition of having become depressed slightly. The level difference arose between the fields which are not made into the field which imprinted the mark in a belt tooth back, and it did not become a flat field. While the latest V ribbed belt is used as an object for the auxiliary machinery drive of an automobile and being twisted in the shape of Sir pen teens especially by multiaxial drive, in order to make a tensioner engage with a belt tooth back, when the concave convex was in such a belt tooth back, said tensioner vibrated and had emitted the noise. Not only it but the belt tooth-back drive which uses a belt tooth back had the problem to which the noise at the time of belt driving becomes large.
[0004] for this reason, to JP,7-96330,B The imprint mark material which made the mark adhere on a base material, and the sail cloth containing an unvulcanized rubber After carrying out heating pressurization of superposition and this so that this mark may face sail cloth, exfoliate a base material and this mark is beforehand imprinted to sail cloth. The mark material which the approach of using this sail cloth at the time of shaping of a belt is indicated [material], and made the mark adhere to JP,8-152048,A on the base material of a nonwoven fabric is made to adhere to the covering sail cloth of a belt, and the approach of making mark material and covering sail cloth one is proposed.
[0005] Moreover, recently, the approach of printing a mark at a direct belt tooth back using an ink jet printer is indicated by JP,7-233992,A, without using mark material. This is the approach of what was specifically cut from the belt sleeve to constant width being prepared, and a fixed number of these being arranged in on belt susceptor, fixing, moving this susceptor to a predetermined location, operating an ink

jet printer, turning ink to the above-mentioned belt, injecting [print a mark by injecting ink directly at a belt tooth back with an ink jet printer,] it from that ink head, and printing a desired mark.
[0006]
[Problem(s) to be Solved by the Invention] However, when imprinting the mark at the belt tooth back, or making the belt tooth back to which the mark was attached contact a pulley by the approach of making imprint mark material a belt and one and using it as a drive side, the problem become to decipherment impossible soon after belt transit was also in the mark a mark is ground by the pulley, become easy to disappear, and contain a special manufacture marker, a trade name, manufacture years, and manufacture lot No. Moreover, also by the approach of printing a mark at a direct belt tooth back using an ink jet printer, since a pulley was worn out in homogeneity in a belt tooth back, there was a problem on which a mark disappears.
[0007] It aims at offering the power transmission belt with a mark which this invention improves such a trouble, the flat side where neither residual ****, the field which moreover attached the mark nor the field which is not so has a level difference in a clear mark maintains [belt], and decreases the noise of a tooth-back drive side even if a belt tooth back is used as a drive side, and does not worsen the mechanical property of the belt by the exposure of a laser beam, and the mark stamp approach.
[0008]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention which relates to claim 1 among this inventions In the power transmission belt which prepared the mark in the tooth back which turns into a drive side in contact with a pulley Even if it is the power transmission belt with a mark which the mark obtained by irradiating a laser beam is stamped on the above-mentioned tooth back, and other fields and level differences do not have the field where a mark exists, either, and is maintaining the flat side and a belt tooth back is used for a drive side As for the mark stamped on the predetermined depth in this field, during after belt transit does not disappear.
[0009] Invention concerning claim 2 is not cut by the laser beam which fiber members, such as core wire and sail cloth, irradiated since the depth of the stamped mark was 0.1-1mm, and the mechanical property of a belt does not receive a bad influence, either.
[0010] Also when the power transmission belt with a mark with which the tooth back which stamps a mark is formed in the rubber layer has invention concerning claim 3, and crack initiation cannot happen from the hollow of the mark stamped on the rubber layer easily and a mark is stamped, members, such as sail cloth, are not cut by the laser beam and the mechanical property of a belt does not change, either.
[0011] Invention concerning claim 4 is the power transmission belt with a mark which adhered the coating which has a color which is different from a tooth back in the hollow of the stamped mark, and a mark pattern becomes still clearer.
[0012] A mark can apply invention concerning claim 5 to the belt with a gear tooth stamped on the tooth-back rubber layer of the belt with a gear tooth formed from the tooth-back rubber layer which laid core wire underground, and the tooth part prepared at the predetermined spacing.
[0013] A mark can apply invention concerning claim 6 to the flat belt stamped on the tooth-back rubber layer of a flat belt. It is and is **.
[0014] In the mark stamp approach of a power transmission belt of having prepared the mark in the tooth back at which invention concerning claim 7 serves as a drive side in contact with a pulley Irradiate a laser beam at the rubber layer of the above-mentioned tooth back, adjusting whenever [angle-of-reflection] by at least one scanning mirror, and a mark is stamped. By being in the mark stamp approach of a power transmission belt of having made it not damage the fiber member laid under the rubber layer, and adjusting the depth of a mark Even if cannot do fatal damage, and it can stamp it on fiber members, such as core wire and sail cloth, and a tooth back is used for a drive side, as for the mark stamped on the predetermined depth in this field, during after belt transit will not disappear.
[0015] The mark stamp approach of a power transmission belt of having stamped the mark with a depth of 0.1-1mm on the tooth-back rubber layer of the belt with a gear tooth formed from the tooth-back rubber layer which laid core wire underground, and the tooth part prepared at the predetermined spacing has invention concerning claim 8, it can do and stamp fatal damage on core wire, and does not reduce

the mechanical property of the belt after a laser beam exposure.
[0016] Invention concerning claim 9 is the mark stamp approach of a power transmission belt of making a power transmission belt standing it still, during the exposure of a laser beam.
[0017]
[Embodiment of the Invention] Drawing of the operation gestalt of this invention is used and explained below. the regions of back under which drawing 1 is the cross-section perspective view of the belt with a gear tooth which is one of the power transmission belts with a mark concerning this invention, and the belt 1 with a gear tooth laid two or more tooth parts 2 and core wire 3 along with the belt longitudinal direction -- it consists of a tooth cloth 5 which covered 4, the tooth part front face 6, and the front face of the bottom section 7.
[0018] The rubber used for said tooth part 2 and regions-of-back 4 has desirable rubber with which heat-resistant aging nature, such as chlorosulfonated polyethylene (CSM) including hydrogenated nitrile rubber, alkylation chlorosulfonated polyethylene (ACSM), and chloroprene rubber, has been improved. The rate of hydrogenation is 80% or more, and 90% or more of hydrogenated nitrile rubber is good in order to demonstrate thermal resistance and the property of ozone resistance. Thermal resistance and ozone resistance fall [hydrogenated nitrile rubber of less than 80% of rates of hydrogenation] to the degree of pole. Although carbon black, a zinc white, stearin acid, a plasticizer, an antioxidant, etc. are added as a compounding agent in the above-mentioned rubber and there are sulfur and organic peroxide as a vulcanizing agent, especially these compounding agents or vulcanizing agents are not restricted.
[0019] As the above-mentioned core wire 3, what twisted the 5-9-micrometer filament of E glass or high intensity glass is processed with the RFL liquid which is the protective agent or adhesives which consists of a rubber composition. moreover, as organic fiber, elongation was small, and twisted the filament which is 0.5-2.5 deniers of the Para system aramid fiber (trade name: Kevlar, theque NORA) with large tensile strength to stress, and it was processed with the adhesives of RFL liquid, an epoxy solution, an isocyanate solution, and a rubber composition -- it twists and a code is used. However, in this invention, it is not limited to these. the diameter of the above-mentioned core wire 3 -- 0.6-1.10mm -- although an entry is carried out, in less than 0.6mm, the tensile strength of core wire 3 is low, and heavy load transmission cannot be borne. On the other hand, if 1.10mm is exceeded, it will not be materialized on a belt dimension.
[0020] the sail cloth used as a tooth cloth 5 is 6 nylon, 66 nylon, polyester, an aramid fiber, etc., and is independent -- or it may be mixed. The configuration of the warp (belt cross direction) of a tooth cloth 5 or the woof (the belt die-length direction) is also the filament yarn or spun yarn of said fiber, and, as for either, ****** is also good by the plain weave fabric, the twill object, and the satin object. In addition, it is desirable to use a part of urethane elastic yarn which has elasticity for the woof.
[0021] The above-mentioned tooth cloth 5 is processed by RFL liquid, an isocyanate solution, or the epoxy solution. RFL liquid is latexes, such as a styrene . butadiene . vinylpyridine ternary polymerization object, hydrogenated nitrile rubber, chlorosulphonated polyethylene, and epichlorohydrin, as a latex which is mixed to a latex and uses the initial condensate of resorcinol and formalin here.
[0022] a deer -- carrying out -- the belt 1 with a gear tooth of this invention -- setting -- regions of back -- 4 consisted of a rubber layer, the tooth back 9 which is the outside surface turned into a drive side which contacts a pulley, and the mark 10 represented by a trademark, manufacture years, a lot number, grade, etc. is stamped. The depth is 0.1-1mm, a laser beam is irradiated, the stamped mark 10 is obtained so that it may mention later, when affecting the mechanical property of the tension strength of a belt etc., it becomes important, and in less than 0.1mm, when wear of a tooth back 4 advances, it has **** to which a mark 10 disappears. if it exceeds 1mm on the other hand -- a laser beam -- regions of back -- there is a danger of having a thermal bad influence on the core wire 3 currently laid under 4, and the dust with which the hollow of a mark 10 tended to be covered with dust etc., and it collected during transit is emitted, and other equipments may be polluted. Moreover, although the width of character of a mark 10 is also 0.1-1mm, this can be adjusted to arbitration.
[0023] The field 11 where the mark 10 stamped on the tooth back 9 exists does not have a level

difference in the boundary section with the other field 12 evenly, either, and it is flat, and it stops also generating the oscillating noise accompanying this, without the pulley which contacts a tooth back 9 vibrating.

[0024] Drawing 2 is the cross-section perspective view of the flat belt 13 concerning this invention, this belt 13 consists of structure which laid the core wire 3, such as a rope, under the interior into the rubber layer 14, and the tooth back 15 is the drive side which a pulley is made to contact. This tooth back 15 consisted only of a rubber layer 14, and the various marks 10 represented by a trademark, manufacture years, a lot number, grade, etc. are stamped.

[0025] It is also possible to adhere the coating which has a color which is different from tooth backs 9 and 15 in the hollow of the mark 10 which the above-mentioned belt 1 with a gear tooth and the flat belt 13 stamped, and the pattern of a mark will become still clearer if it does in this way.

[0026] The approach of irradiating the above-mentioned laser beam and stamping a mark CO2 oscillated from the laser oscillation section 20 as shown in drawing 3 It carries out as [become / a laser spot / bring together the laser beams 21 for printing, such as a laser beam, in a condenser lens 22, and / on a front face / min]. Making the scanning mirror 24 scan and adjusting whenever [angle-of-reflection / of a laser beam 21] by the control section 23, the tooth backs 9 and 15 of the belts 1 and 13 installed on the movable susceptor 25 are irradiated, and a mark 10 is stamped by predetermined within the limits. the laser beam 21 which the principle that this can be burned in a front face is resembled, and was irradiated -- tooth backs 9 and 15 -- melt some rubber in an instant, it is made to evaporate very much, and a hollow 27 is formed.

[0027] In stamping the mark outside the predetermined range, after moving susceptor 25 to 1 shaft orientations in parallel, a laser beam 21 is irradiated again and it stamps the new mark 10. That is, if three characters, A, B, and C, are maximum ranges, after moving susceptor 25, other alphabetic characters will be stamped.

[0028] This laser beam 21 can draw the desired alphabetic character inputted by scanning the scanning mirror 24 automatically according to the program which the control section 23 which inputted data, such as an alphabetic character, a notation, and a graphic form, beforehand inputted, and controlling ON of a laser beam 21, and OFF, a notation, and a graphic form. Since the tooth backs 9 and 15 of a belt and the distance of the scanning mirror 24 are comparatively as short as about 100-150mm and it is not necessary to carry out the long duration exposure of the strong laser beam 21, the configuration member of a belt, for example, core wire etc., is not damaged with heat.

[0029] Drawing 4 shows the condition of having irradiated the laser beam 21 and having stamped the mark 10 on the tooth backs 9 and 15 of belts 1 and 13 by predetermined within the limits, and the hollow 27 with a depth of 0.1-1mm of a mark 10 is stamped. Thereby, cannot do fatal damage and it can be stamped on the fiber member of core wire 3.

[0030] In addition, although it does not change mechanical properties, such as tensile strength of a belt, in facing stamping a mark 10 using the above-mentioned laser beam 21 and irradiating the front face of a direct rubber layer, if a laser beam 21 is irradiated in a sail cloth side, you cut the configuration yarn of sail cloth and it is made to be damaged, and since this causes a fall for the mechanical characteristic of a belt, it is not desirable.

[0031]

[Example] Hereafter, an example explains this invention to a detail.

After giving vibration underwater and shrinking textiles after carrying out weaving of the textiles by the woof which consists of warp of 66 nylon of 1140 deniers of examples, and 66 280 deniers nylon and 140-denier urethane elastic yarn to about 1 of the width of face at the time of weaving / two pieces, it immersed and dried on the rubber cement which consists of a hydrogenated-nitrile-rubber constituent, the rubber sheet of a hydrogenated-nitrile-rubber constituent was further stuck to the above-mentioned textiles by pressure, and it considered as the tooth cloth.

[0032] Next, it was immersed in the RFL liquid which is a protective agent and adhesives, after desiccation, the bottom twist was performed and it considered as the strand, as a core wire, E glass filament of 9 micrometers of diameters of a strand was lengthened the number of predetermined, and

was arranged, the strand was lengthened the number of predetermined and arranged, with the bottom twist, the upper twist was given to hard flow and the twist code of S and Z pair was produced.
[0033] Each tooth cloth was set to the endless-like tube-like object, and finishing and this were set to metal mold. The code of S and Z pair was twisted by turns from moreover, the rolling sheet of a hydrogenated-nitrile-rubber constituent was twisted on it, by the vulcanization approach by the usual press fit, after vulcanization, the vulcanization sleeve was cut to predetermined width of face, and each belt was produced. Belt sizes were number-of-teeth:105, belt width-of-face:19.1mm, and gear-tooth pitch:8mm, and the tooth form of a belt was STPD.
[0034] Next, CO2 which used equipment as shown in drawing 3 , and was oscillated from the laser oscillation section Brought together the laser beam (12W, a class 4, wavelength of 10.6 micrometers) in the condenser lens, the scanning mirror connected with the control section was made to scan to biaxial, the tooth back of the belt on the susceptor which adjusted distance with a scanning mirror to 130mm was irradiated, and the mark with a depth of 0.5mm was stamped on the front face.
[0035] What printed the direct mark at the belt tooth back on the other hand, using an ink jet printer as a belt on which a mark is not stamped was used.
[0036] The belt with a gear tooth on which the mark was stamped, and the belt with a gear tooth which printed the mark with the ink jet printer, the multiaxial crookedness driving test machine was equipped with and run, and the existence of the mark disappearance when resulting in the life of each belt was investigated. The result is shown in Table 1.
[0037] Phase opposite is carried out and the above-mentioned multiaxial crookedness driving test machine 30 arranges the drive pulley 31 (number of teeth 24), two fixed follower pulleys 32 and 33 (each number of teeth 24), and one movable follower pulley 34 (number of teeth 24), as shown in drawing 5 , and it places the AIRA pulleys 35, 36, 37, and 38 of 32mm of diameters phi of a pulley between each pulley. And as transit conditions, they are the ambient atmosphere environmental temperature C of 100 degrees, axial load 60kgf, and rotational frequency 5500rpm of a driving pulley 16.
[0038] Moreover, it attached and ran the belt with a gear tooth on which the mark was stamped, and the belt with a gear tooth which printed the mark to 3 shaft heatproof driving test, and the tensile strength of the belt after transit was measured.
[0039] This 3 shaft heatproof driving test 40 consists of a drive pulley 41 (number of teeth 21), and the follower pulley 42 (number of teeth 42) and a tension pulley 43 (diameter of pulley 52mmphi), as shown in drawing 6 . A belt is twisted around a driving pulley 41 and the follower pulley 42, and it engaged with the tension pulley 43 and engine-speed 7,200rpm of the drive pulley 41 and the follower pulley 42 were run the belt tooth back with load 5ps and the belt initial tension of 15kg with the ambient atmosphere environmental temperature of 120-degreeC. And the tensile strength of the belt after 500-hour transit was measured. The result is shown in Table 1.
[0040]
[Table 1]

	マークを刻印した歯付ベルト	マークを印刷しない歯付ベルト
多軸屈曲走行による走行寿命（時間）	435	430
多軸屈曲走行によるマーク消失の有無	無	多く有
3軸耐熱走行試験後のベルトの引張強さ（Kg / ベルト幅19.1mm）	960	1090

[0041] When it depends as a result, since there is no difference compared with the belt with a gear tooth with which the belt with a gear tooth on which the mark was stamped does not have disappearance of a mark to the life of a belt, and the tensile strength of the belt after transit also printed the mark, it turns out that the mechanical characteristic of a belt is not falling by the exposure of a laser beam. However, when a mark is beginning to have disappeared in the transit time and the belt with a gear tooth which printed the mark was the life of a belt, the mark had disappeared partially.
[0042]
[Effect of the Invention] As mentioned above, invention which relates to claim 1 among this inventions In the power transmission belt which prepared the mark in the tooth back which turns into a drive side in contact with a pulley Even if it is the power transmission belt with a mark which the mark obtained by irradiating a laser beam is stamped on the above-mentioned tooth back, and other fields and level differences do not have the field where a mark exists, either, and is maintaining the flat side and a belt tooth back is used for a drive side As for the mark stamped on the predetermined depth in this field, during after belt transit does not disappear.
[0043] Invention concerning claim 2 is not cut by the laser beam which fiber members, such as core wire and sail cloth, irradiated since the depth of the stamped mark was 0.1-1mm, and the mechanical property of a belt does not receive a bad influence, either.
[0044] Also when the power transmission belt with a mark with which the tooth back which stamps a mark is formed in the rubber layer has invention concerning claim 3, and crack initiation cannot happen from the hollow of the mark stamped on the rubber layer easily and a mark is stamped, members, such as sail cloth, are not cut by the laser beam and the mechanical property of a belt does not change, either.
[0045] Invention concerning claim 4 is the power transmission belt with a mark which adhered the coating which has a color which is different from a tooth back in the hollow of the stamped mark, and the pattern of a mark becomes still clearer.
[0046] A mark can apply invention concerning claim 5 to the belt with a gear tooth stamped on the tooth-back rubber layer of the belt with a gear tooth formed from the tooth-back rubber layer which laid core wire underground, and the tooth part prepared at the predetermined spacing.
[0047] A mark can apply invention concerning claim 6 to the flat belt stamped on the tooth-back rubber layer of a flat belt. It is and is **.
[0048] Invention concerning claims 7-9 is the mark stamp approach of a power transmission belt, and a laser beam is irradiated at the rubber layer of the above-mentioned tooth back, adjusting whenever [angle-of-reflection] by at least one scanning mirror. By being in the mark stamp approach of a power transmission belt of having made it not damage the fiber member which stamped the mark and was laid under the rubber layer, and adjusting the depth of a mark to 0.1-1mm Even if cannot do fatal damage, and it can stamp it on fiber members, such as core wire and sail cloth, and a belt tooth back is used for a drive side, as for the mark stamped on the predetermined depth in this field, during after belt transit will not disappear.

[Translation done.]

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CLAIMS

[Claim(s)]
[Claim 1] The power transmission belt with a mark characterized by stamping the mark obtained by irradiating a laser beam on the above-mentioned tooth back in the power transmission belt which prepared the mark in the tooth back which turns into a drive side in contact with a pulley, and for the field where a mark exists not having other fields and level differences, either, and maintaining the flat side.
[Claim 2] The power transmission belt with a mark according to claim 1 whose depth of the stamped mark is 0.1-1mm.
[Claim 3] The power transmission belt with a mark according to claim 1 or 2 with which the tooth back which stamps a mark is formed in the rubber layer.
[Claim 4] The power transmission belt with a mark according to claim 1, 2, or 3 which adhered the coating which has a color which is different from a tooth back in the hollow of the stamped mark.
[Claim 5] Claims 1 and 2 stamped on the tooth-back rubber layer of the belt with a gear tooth formed from the tooth-back rubber layer under which the mark laid core wire, and the tooth part prepared at the predetermined spacing, or a power transmission belt with a mark given in three.
[Claim 6] Claims 1 and 2 by which the mark is stamped on the tooth-back rubber layer of a flat belt, or a power transmission belt with a mark given in three.
[Claim 7] The mark stamp approach of the power transmission belt characterized by making it not damage the fiber member which irradiated the laser beam at the rubber layer of the above-mentioned tooth back, adjusting whenever [angle-of-reflection] by at least one scanning mirror, stamped the mark in the mark stamp approach of a power transmission belt of having prepared the mark in the tooth back which turns into a drive side in contact with a pulley, and laid under the rubber layer.
[Claim 8] The mark stamp approach of a power transmission belt according to claim 7 of having stamped the mark with a depth of 0.1-1mm on the tooth-back rubber layer of the belt with a gear tooth formed from the tooth-back rubber layer which laid core wire underground, and the tooth part prepared at the predetermined spacing.
[Claim 9] The mark stamp approach of a power transmission belt according to claim 7 or 8 of making a power transmission belt standing it still during the exposure of a laser beam.

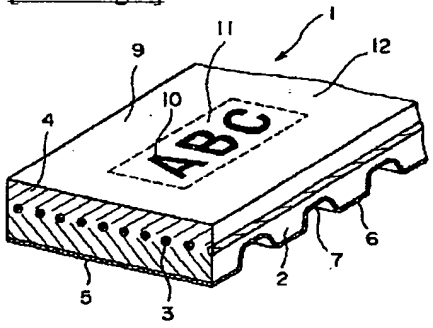
[Translation done.]

* NOTICES *

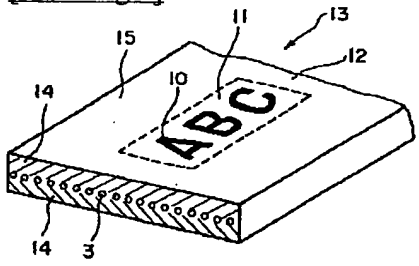
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

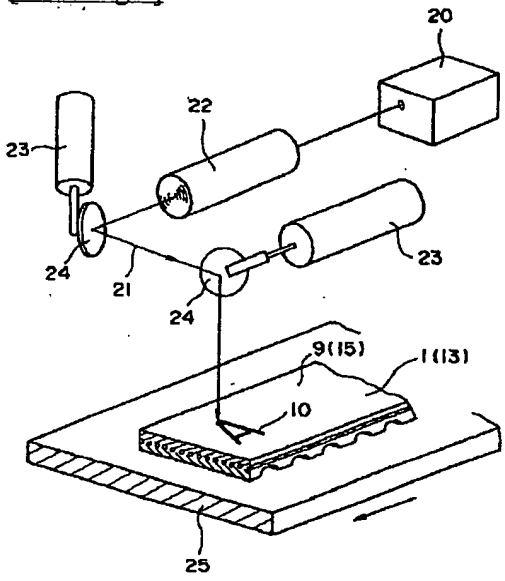
[Drawing 1]



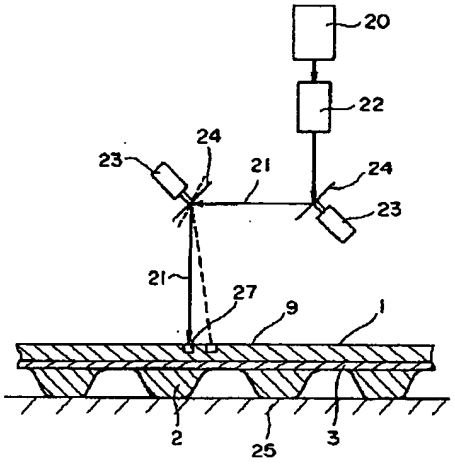
[Drawing 2]



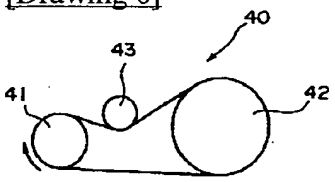
[Drawing 3]



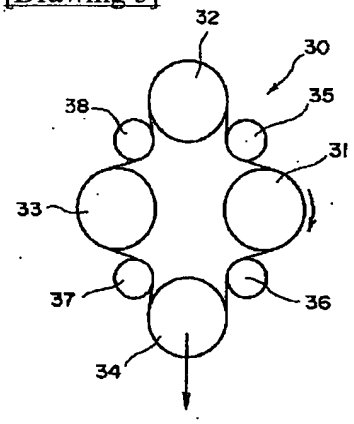
[Drawing 4]



[Drawing 6]



[Drawing 5]



[Translation done.]